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MAN LABOR, HORSE WORK AND MATERIALS  
USED IN PRODUCING CROPS IN CHRISTIAN  
COUNTY.

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tobacco. For the most part, however, Christian County farming is centered around four crops, tobacco, corn, wheat, and hay.

According to the 1925 Agricultural Census of the United States corn is raised on 48 out of every 100 acres of harvested crop area in the county, tobacco is raised on 17 acres, wheat on 9 acres and hay on 19 acres, the remainder of the crop land being devoted to the production of minor and miscellaneous crops.

The principal share of the investment in livestock on most farms is carried in work animals, altho considerable attention is given to dairying in some sections. Hogs are raised in limited numbers on practically all farms, but taking the county as a whole the industry is a relatively minor one. Poultry is to be found on nearly every farm in the region, tho in most cases this enterprise is largely confined to supplying needs of the home. Some beef cattle are produced and occasionally there is a farmer who raises sheep. On the whole most of the energies of Christian County farmers are directed toward the production of field crops.

Farmers generally are interested in getting the largest possible returns for the man labor, horse work, and other resources used upon the crops and livestock produced. That is, they are continually trying to apportion their resources among the different crop and livestock enterprises and decide upon the methods and practices within these enterprises so as to get the largest possible returns. In this bulletin attention is confined largely to one part of this problem—that part relating to the methods and practices used in growing the principal crops as revealed by the records obtained. The variations in the amounts of man labor and horse work used in producing these crops on different farms, together with the reasons for these variations, are discussed in the first part of the bulletin. In the appendix the materials, including seed, fertilizer and other items used and more of the details of the man labor and horse work are shown.

In western Kentucky as in other areas, returns from a particular crop on farms with similar resources vary widely from farm to farm. That is, some farmers get a larger quantity, or a better quality of product for a given outlay of man labor, horse

work, and other expenses of production than do other farmers. This is true even when a period of years is considered. A large part of these differences are due to factors within the farmers' control.

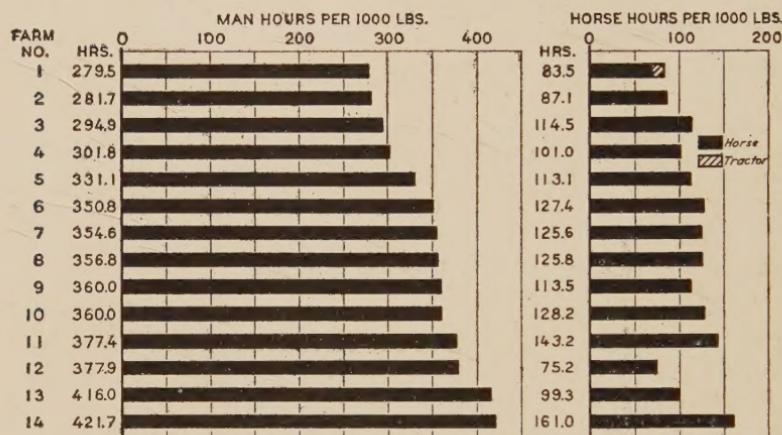
In the tables and charts the farms are arrayed on the basis of the hours of man labor used per unit of product, with the hours of horse work shown opposite in each case. There was a marked tendency for the man labor and horse work used per unit of product to increase and decrease together.

It is realized that the returns from crops are determined partly by prices. For each of the three crops, corn, wheat, and hay, prices were fairly uniform from farm to farm. For tobacco price variations were common. However, in this study farmers who used small amounts of man labor and horse work in producing 1,000 pounds of tobacco also as a rule obtained high prices. (See footnote 4, page 388). It is believed that the amounts of man labor and horse work used in producing a given quantity of a particular crop suggest to some extent the efficiency of different growers of that crop.<sup>3</sup>

#### TOBACCO

The hours of man labor and horse work used in producing 1,000 pounds of tobacco on the different farms during the three-year period from 1921 to 1923 are shown in Figure 1. Some farmers were able to get 1,000 pounds of this dark fire-cured tobacco by using less than 300 hours of man labor and 100 hours of horse work, while other farmers used over 400 hours of man labor and 150 hours of horse work in producing the same quantity.

<sup>3</sup> This is true when the land and materials used per unit of product decrease or remain constant as the man labor and horse work decrease. The use of the amount of labor expended per unit of product as an approximate index of efficiency is checked in the cost calculations of the appendix, in which unit costs are calculated for the farms showing the lowest and highest amounts of labor used per unit of product. See pages 411, 418, 428 and 433. Both the man labor index used here and the cost index suggested in the appendix assume that the labor was of the same quality on the different farms and that the different farmers had approximately the same alternatives for the labor and other resources used. While the assumptions are not entirely true it is believed that enough uniformity exists to permit significant comparisons to be made.

Fig. 1.—Man labor and horse work used in producing tobacco.<sup>1</sup>

<sup>1</sup> Man labor and horse work used in producing tobacco and yield obtained in Christian County for the period 1921-23, inclusive.

Farm Number <sup>1</sup>	Total Acres Per Farm	Yield Per Acre (Lbs.)	Hours Per Acre		Hours Per 1000 Lbs. Tobacco	
			Man	Horse	Man	Horse
1	99.1	949	265.3	65.6	279.5	69.1
2 <sup>3</sup>	30.9	866	244.0	75.4	281.7	87.1
3 <sup>3</sup>	14.4	902	266.0	103.3	294.9	114.5
4	20.9	1056	318.9	106.7	301.8	101.0
5 <sup>4</sup>	16.6	909	300.9	102.8	331.1	113.1
6	25.4	798	280.1	101.7	350.8	127.4
7	59.8	568	201.3	71.3	354.6	125.6
8	36.5	666	237.8	83.9	356.8	125.8
9	45.5	605	217.8	68.7	360.0	113.5
10	32.9	735	264.5	94.2	360.0	128.2
11	42.4	874	330.0	125.2	377.4	143.2
12 <sup>4</sup>	21.0	933	352.4	70.1	377.9	75.2
13	35.7	641	266.8	63.7	416.0	99.3
14 <sup>3</sup>	23.8	605	255.3	97.4	421.7	161.0
Average				.45 T		.57 T
Average			783	82.7	335.9	105.7

<sup>1</sup> Farms are listed in order of man hours expended per 1,000 pounds tobacco, beginning with the lowest.

<sup>2</sup> T is used to denote tractor work. In constructing the charts the assumption is made that one hour of tractor work is equivalent to six hours of horse work.

<sup>3</sup> Includes only 1922 and 1923.

<sup>4</sup> Includes only 1921 and 1922.

Yield per acre is important in determining the amount of labor needed to produce 1,000 pounds of tobacco. The natural fertility of the soil and the cropping system followed are important in determining yield. However, some of the most fertile farms in the study showed high labor requirements per unit of product. The cropping systems are similar on most of the farms.

This suggests that there are other factors in addition to the fertility of the soil and cropping system that influence the amount of tobacco obtained from a given amount of labor. From the time the tobacco plant beds are prepared in the spring until stripping and marketing are completed the following spring 30 to 40 different kinds of operations are necessary. Some farmers use more labor in performing the different operations than do other farmers. Some farmers use a different group or set of operations from those used by other farmers.

The operations most commonly performed in producing tobacco and the amounts of labor needed with different crews and equipment are shown in Tables 1 to 6. These may be considered as suggested standards of accomplishment. Many farmers use considerably more labor than is suggested here for the different operations; some approach these standards; a few use less labor. These standards are based upon the accomplishments of some of the more successful tobacco growers in the area.

The group or set of operations selected greatly influence the labor requirements. For example, if the land is thoroly disked, harrowed and dragged, a two- or three-row marker may be used and only a small amount of labor will be needed in getting ready for transplanting. If, on the other hand, the disking, harrowing, and dragging operations are neglected or poorly done a relatively large amount of labor will be needed in laying off and hilling. The decisions regarding such operations as these and the amounts of man labor and horse work used in performing them are important in determing the farm to farm variations.

TABLE 1.—Man Labor and Horse Work Requirements in Plant Bed Preparation

Operations <sup>1</sup>	Usual Dates	Crew and Equipment	Sq. Yds. Per 10-Hr. Day	Hrs. of Labor Per 100 Sq. Yds.		Hrs. Per Acre <sup>2</sup>	
				Man	Horse	Man	Horse
Steaming plant bed	Jan. 1-Mar. 31	4 men, 2 horses, boiler, 3 yd. by 4 yd. steaming box and water wagon OR 4 men, 2 horses, boiler, 4 yd. by 5 yd. steaming box and water wagon	180	22.2	11.1	4.4	2.2
		2 men, 1 horse	300	13.3	6.7	2.7	1.3
Cutting wood and brush and burning plant bed	Feb. 1-Mar. 31	2 men, 1 horse	50	40.0	20.0	8.0	4.0
Misc. pulverizing, sowing and canvassing plant bed	Feb. 1-Apr. 15	2 men, 1 horse	200	10.0	5.0	2.0	1.0

<sup>1</sup> It will be observed that two different sizes of steaming boxes are suggested. Also the requirements for burning plant beds are suggested. At a particular time one or the other of the steaming boxes would be used or the plant bed would be burned.

<sup>2</sup> These figures are based on the assumption that 100 square yards of bed will provide enough plants for 5 acres of tobacco.

By following a cropping system that will permit a yield of 900 to 1,000 pounds of tobacco per acre and using reasonable judgment in selecting the different operations and performing them within the time suggested most farmers in western Kentucky should be able to obtain 1,000 pounds of good quality tobacco for each 300 hours of man labor and 100 hours of horse work devoted to tobacco.<sup>4</sup>

<sup>4</sup> In growing tobacco the farm to farm variations in quality are often of more significance than the variations in yields. This suggests that it would pay many farmers in the area to give more attention to quality. It is of interest to note that the men in this study who used small amounts of man labor and horse work per 1,000 pounds of tobacco also as a rule received high prices for their tobacco. Farms 1 to 7 received an average price of 17 cents per pound during the period considered, while farms 8 to 14 received only 13½ cents per pound. (See Table 13.)

TABLE 2.—Man Labor and Horse Work Requirements in Breaking, Preparing Land, Planting and Cultivating Tobacco.

Operations <sup>1</sup>	Usual Dates	Crew and Equipment <sup>2</sup>	Acres in 10-hr. Day	Hrs. Per Acre <sup>3</sup>	
				Man	Horse
Breaking	Nov. 1-May 15 <sup>4</sup>	2-horse plow or 3-horse plow	2.0 2.8	5.0 3.6	10.0 10.7
Disking	Apr. 15-May 31	6-ft. disk, 3 horses or 8-ft. disk, 4 horses (1 to 3 times over)	6.0 8.0	1.7 1.2	5.0 5.0
Harrowing and dragging	Apr. 15-May 31	12-ft. harrow, 4 horses or 10-ft. harrow or drag, 3 horses, or 6-ft. harrow or drag, 3 horses (1 to 2 times over)	24.0 18.0 12.0	.4 .6 .8	1.7 1.7 2.5
Fertilizing, marking off or	May 10-June 10 <sup>5</sup>	6-ft. drill, 3 horses, or 4-ft. drill, 2 horses Four-row marker, 2 horses (both ways)	12.0 8.0 16.0	.8 1.2 .6	2.5 2.5 1.2
Laying off, hillling or	May 10-June 10	2-row cultivator (one way) 1-row hillier (one way)	16.0 8.0	.6 1.2	1.2 2.5
Laying off, fertilizing, or	May 10-June 10	2-row corn planter with fert. attach. (Both ways), or 1-row corn planter with fert. attach. (Both ways) Hand hoe	8.0	1.2	2.5
Hilling or			4.0 2.0	2.5 5.0	2.5
Laying off Fertilizing Hilling	May 10-June 10	1-horse plow (both ways) By hand Hand hoe	2.0 6.0 1.0	5.0 1.7 10.0	5.0 ..... .....
Transplanting	May 1-June 15	By hand	1.0	10.0	.....
Plowing	May 20-July 31	1-horse plow (or harrow) or 2-horse plow (5 to 8 times over)	4.0 8.0	2.5 1.2	2.5 2.5
Hoeing	May 20-July 31	Hand hoe (1 to 2 times over)	1 to 2	5 to 10	.....

<sup>1</sup> Only one of the four sets of operations suggested by the headings "Fertilizing, marking off," "Laying off, hillling," "Laying off, fertilizing, hillling," and "Laying off fertilizing hillling" would be done at a particular time.

<sup>2</sup> Two or more different crews are shown for many operations. Only one of these would be used at a particular time.

<sup>3</sup> Per acre requirements are reported on the basis of one time over for the operation. They do not suggest the total man labor and horse work required for these operations. The figures shown multiplied by the "times over" would give such totals.

<sup>4</sup> Practically no days in January and February and very few days in March are available for breaking for tobacco.

<sup>5</sup> Fertilizer may be hauled for tobacco at any time during the early spring.

TABLE 3.—Man Labor Requirements in Topping, Worming, Suckering and Spraying Tobacco (1000 lbs. per acre).

Operations	Usual Dates	Crew and Equipment	Acres in 10-hr. Day		Hrs. Per Acre <sup>1</sup>	
			Man	Horse	Man	Horse
Spraying	July 15-Aug. 15	Hand sprayer (1 to 2 times over)	6.0	1.7	.....	.....
Top and worm	July 15-Aug. 15	By hand (2 to 3 times over)	1.5 to 3.0	3.3 to 6.7	.....	.....
Sucker and worm	Aug. 1-Sept. 20	By hand (5 to 6 times over)	1.0 to 2.0	5.0 to 10.0	.....	.....

<sup>1</sup> Per acre requirements are reported on the basis of one time over for the operation. They do not suggest the total man labor and horse work required for these operations. The figures shown multiplied by the "times over" would give such totals.

TABLE 4.—Man Labor and Horse Work Requirements in Cutting and Housing Tobacco (1000 lbs. per acre).

Operations	Usual Dates	Crew and Equipment <sup>1</sup>	Acres in 10-hr. Day		Hrs. Per Acre	
			Man	Horse	Man	Horse
Cutting and housing	Aug. 20-Sept. 30	4 men, 2 horses and wagon, or 6 men, 2 horses and wagon, or 8 men, 4 horses and 2 wagons	1.6	25.0	12.5	
			2.5	24.0	8.0	
			3.6	22.2	11.1	

<sup>1</sup> See footnote <sup>2</sup> Table 2.

TABLE 5.—Man Labor and Horse Work Requirements in Curing Tobacco (1000 lbs. per acre).

Operations	Usual Dates	Crew and Equipment	Acres in 10-hr. Day		Hrs. Per Acre	
			Man	Horse	Man	Horse
Cut and haul wood	All year	2 men and 2 horses	3.0	6.7	6.7	
Haul sawdust	Aug. 1-Sept. 15	1 man and 2 horses	4.0	2.5	5.0	
Firing	Aug. 25-Oct. 31	1 man to 5 to 10 acres	.....	15 to 25	.....	.....

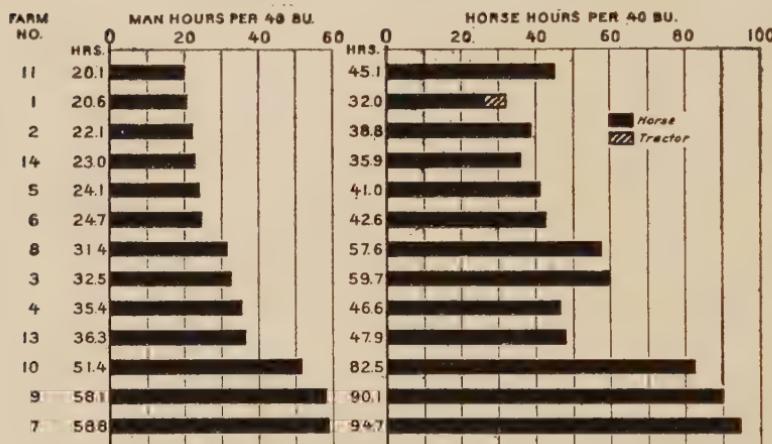
TABLE 6.—Man Labor and Horse Work Requirements in Stripping and Marketing Tobacco (1000 lbs. per acre).

Operations	Usual Dates	Crew and Equipment	Acres in 10-hr. Day	Hrs. Per Acre	
				Man	Horse
Stripping and bulking	Nov. 20-Apr. 30	1 man	.2	50.0	.....
Loading	Dec. 1-Apr. 30	3 men	8.0	3.7	.....
Hauling	Dec. 1-Apr. 30	2 men, 4 horses	3.0 to 8.0	2.5 to 6.7	5.0 to 13.3

## CORN

The hours of man labor and horse work used in producing 40 bushels of corn on the different farms for 1922 and 1923 are shown in Figure 2. Some farmers used only about 25 man hours and 35 horse hours in producing 40 bushels of corn while other farmers used more than 50 hours of man labor and 75 hours of horse work in growing the same amount. The soils and cropping systems on the different farms are responsible for some of these differences but the variations are wide for farms with similar soils and like cropping systems. The selection of the different operations and the size of the implement and crew used in performing these operations are important in determining the farm to farm variations.

The operations and the amounts of labor for each with crews and equipment of different sizes are shown in Tables 7 and 8. As suggested in Table 7 only about one-half as much man labor will be needed in planting corn with a two-row planter as with a one-row planter and only one-half as much in cultivating with a two-horse cultivator as with a one-horse cultivator. Often less man labor and horse work will be needed if the seed bed is thoroly prepared before the corn is planted; that is, careful field preparation often means that the added labor used will displace an even larger amount of labor during the cultivating season. Thoro and timely field preparation, generally, also means larger yields.

Fig. 2.—Man labor and horse work used in producing corn.<sup>1</sup>

<sup>1</sup> Man labor and horse work used in producing corn and yield obtained in Christian County for the years 1922 and 1923.

Farm Number <sup>2</sup>	Total Acres Per Farm	Yield Per Acre (Bus.)	Hours Per Acre <sup>1</sup>		Hours Per 40 Bus. Corn	
			Man	Horse	Man	Horse
11	83.5	49.0	24.6	55.2	20.1	45.1
1	263.8	38.9	20.0	25.4	20.6	26.1
2	75.5	44.8	24.7	43.5	22.1	38.8
14	244.9	40.6	23.3	36.4	23.0	35.9
5	70.0	39.7	24.0	40.8	24.1	41.0
6	53.9	43.9	27.1	46.8	24.7	42.6
8	58.9	26.5	20.8	38.2	31.4	57.6
3	133.5	24.8	20.1	37.0	32.5	59.7
4	38.9	31.8	28.1	37.0	35.4	46.6
13	59.6	32.5	29.5	38.9	36.3	47.9
10	61.3	21.5	27.6	44.2	51.4	82.5
9	41.9	19.0	27.7	42.9	58.1	90.1
7	37.0	22.8	33.6	54.1	58.8	94.7
Average		35.8	23.6	37.9	26.4	42.3

<sup>1</sup> These data are presented on the basis of harvesting by snapping from the standing stalk.

<sup>2</sup> Farms are listed in order of man hours expended per 40 bushels corn, beginning with the lowest.

TABLE 7.—Man Labor and Horse Work Requirements in Breaking, Preparing Land, Planting and Cultivating Corn.

Operations	Usual Dates	Crew and Equipment <sup>1</sup>	Acres in 10-hr. Day	Hrs. Per Acre <sup>2</sup>	
				Man	Horse
Breaking	Nov. 1-May 15	2-horse plow or 3-horse plow	2.0 2.8	5.0 3.6	10.0 10.7
Disking	Apr. 15-June 10	6-ft. disk, 3 horses or 8-ft. disk, 4 horses (double disking)	6.0 8.0	1.7 1.2	5.0 5.0
Harrowing and dragging	Apr. 15-June 10	12-ft. harrow, 4 horses or 9-ft. harrow or drag, 3 horses or 6-ft. harrow or drag, 3 horses	24.0 18.0 12.0	.4 .6 .8	1.7 1.7 2.5
Planting	Apr. 20-June 10	2-row planter or 1-row planter	16.0 8.0	.6 1.2	1.2 1.2
Chopping and hoeing	June 1-July 1	Hand hoe	3 to 5	2 to 3.3	.....
Plowing	May 1-July 10	2-horse plow, or 1-horse plow (3 to 5 times over)	8.0 4.0	1.2 2.5	2.5 2.5

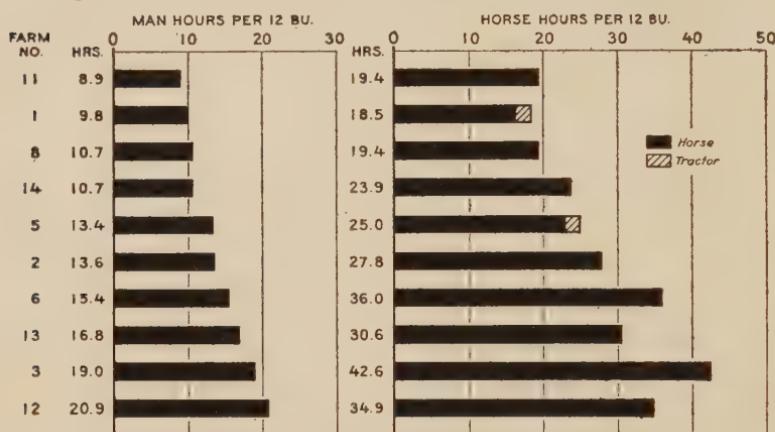
<sup>1</sup> See footnote <sup>2</sup> Table 2.

<sup>2</sup> Per acre requirements are reported on the basis of one time over for the operation. They do not suggest the total man labor and horse work required for these operations. The figures shown multiplied by the "times over" would give such totals.

TABLE 8.—Man Labor and Horse Work Requirements in Harvesting Corn (40 bushels per acre).

Operations	Usual Dates	Crew and Equipment	Acres in 10-hr. Day	Hrs. Per Acre	
				Man	Horse
Cutting and shocking	Sept. 15-Oct. 15	One man, by hand	1.5	6.7	.....
Husking from shock and hauling grain or	Nov. 1-Jan. 1	2 men, 2 horses and wagon	2.0	10.0	10.0
Snapping and hauling	Nov. 1-Jan. 1	2 men, 2 horses and wagon	3.0	6.7	6.7

It is believed that by carefully selecting the operations and performing them within the time suggested in Tables 7 and 8 a large proportion of the farmers of western Kentucky would be able to obtain on the average 40 bushels of corn for each 25 man and 35 horse hours devoted to corn. At least this is a reasonable standard toward which to work.

Fig. 3.—Man labor and horse work used in producing wheat.<sup>1</sup>

<sup>1</sup> Man labor and horse work used in producing wheat and yield obtained in Christian County for the period 1921-23 inclusive.

Farm Number <sup>1</sup>	Total Acres Per Farm	Yield Per Acre (Bus.)	Hours Per Acre		Hours Per 12 Bus. Wheat	
			Man	Horse	Man	Horse
11	151.3	10.6	7.8	17.2 31 T	8.9 37 T	19.4 31 T
1	249.0	10.1	8.3	13.8	9.8	16.3
8	73.8	13.3	11.8	21.4	10.7	19.4
14 <sup>2</sup>	185.1	11.8	10.5	23.5 .36 T	10.7	23.9 .31 T
5	100.0	13.9	15.5	26.7	13.4	23.1
2 <sup>2</sup>	117.0	6.9	7.9	16.1	13.6	27.8
6	133.7	7.5	9.7	22.6	15.4	36.0
13	52.9	9.0	12.6	22.9	16.8	30.6
3	273.1	9.5	15.0	33.8	19.0	42.6
12 <sup>3</sup>	34.7	8.1	14.1	23.6 .08 T	20.9	34.9 .10 T
Average		10.1	11.0	22.5	13.1	26.7

<sup>1</sup> Farms are listed in order of man hours expended per 12 bushels wheat, beginning with the lowest.

<sup>2</sup> Includes only 1922 and 1923.

<sup>3</sup> Includes only 1921 and 1922.

## WHEAT

The hours of man labor and horse work used in producing 12 bushels of wheat on the different farms during the period from 1921 to 1923 are shown in Figure 3. Some farmers used only 10 to 12 hours of man labor and 20 to 25 hours of horse work in producing 12 bushels of wheat, while other farmers used 15 to 20 man hours and 30 to 40 horse hours in producing the same amount.

TABLE 9.—Man Labor and Horse Work Requirements in Preparing Land and Sowing Wheat.

Operations	Usual Dates	Crew and Equipment <sup>1</sup>	Acres in 10-hr. Day	Hrs. Per Acre <sup>2</sup>	
				Man	Horse
Breaking	Aug. 1-Oct. 1	2-horse plow or 3-horse plow	2.0 2.8	5.0 3.6	10.0 10.7
Disking	Aug. 1-Oct. 15	6-ft. disk, 3 horses or 8-ft. disk, 4 horses (1 to 2 times over, double disking)	6.0 8.0	1.7 1.2	5.0 5.0
Harrowing and dragging	Aug. 1-Oct. 15	5-ft. harrow or drag, 2 horses or 9-ft. harrow or drag, 3 horses or 12-ft. harrow, 4 horses (1 to 2 times over)	10.0 18.0 24.0	1.0 .6 .4	2.0 1.7 1.7
Fertilizing, sowing	Oct. 1-Oct. 20	6-ft. drill, 3 horses 4-ft. drill, 2 horses	12.0 8.0	.8 1.2	2.5 2.5

<sup>1</sup> See footnote <sup>2</sup> Table 2.

<sup>2</sup> Per acre requirements are reported on the basis of one time over for the operation. They do not suggest the total man labor and horse work required for these operations. The figures shown multiplied by the "times over" would give such totals.

TABLE 10.—Man Labor and Horse Work Requirements in Harvesting Wheat. (12 bushels per acre.)

Operations	Usual Dates	Crew and Equipment <sup>1</sup>	Acres in 10-hr. Day	Hrs. Per Acre	
				Man	Horse
Cutting	June 10-June 25	8-ft. binder, 4 horses or 6-ft. binder, 3 horses	20.0 15.0	.5 .7	2.0 2.0
Shocking	June 10-June 25	By hand (2 men)	20.0	1.0	.....
Threshing	June 25-July 31	13 men, 14 horses 3 men, 2 horses—machine	50.0 50.0	2.6 Usually hired by contract	2.8

<sup>1</sup> See footnote <sup>2</sup> Table 2.

Some of the reasons for variations in the amounts of labor used by various men in producing wheat are suggested in Tables 9 and 10. The selection of the operation, crew and equipment gives many opportunities for variations. These, together with differences in yields, account in a large way for the differences in the amounts of man labor and horse work used in producing a given quantity of wheat on different farms.

#### MIXED HAY

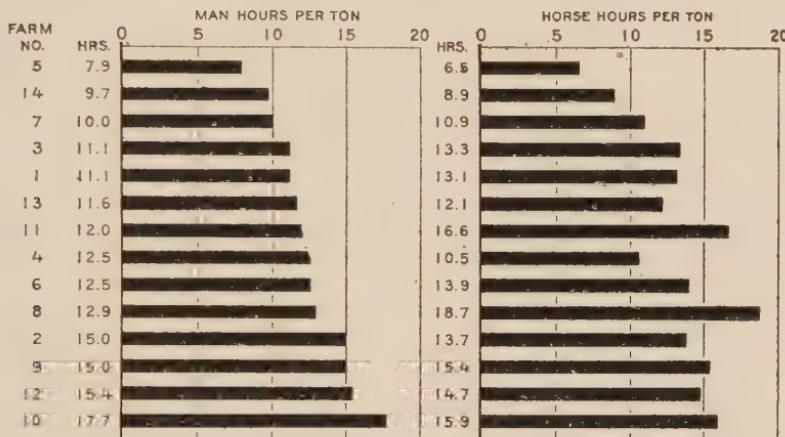
The hours of man labor and horse work used in producing one ton of hay on the different farms from 1921 to 1923 inclusive are shown in Figure 4. The expenditures ranged from less than 10 hours of man labor and 10 hours of horse work to more than 15 hours of man labor and 15 hours of horse work per ton. Some of the reasons for these variations are suggested in Table 11. These are believed to represent reasonable standards toward which to work in performing the different operations.

**TABLE 11.—Man Labor and Horse Work Requirements in Producing Mixed Hay. (1 ton per acre.)**

Operations	Usual Dates	Crew and Equipment <sup>1</sup>	Acres in 10-hr. Day	Hrs. Per Acre	
				Man	Horse
Seeding	Feb. 1-Mar. 31	Hand seeder	15	.7	.....
Cutting	June 10-June 25	6-ft. mower, 2 horses or 5-ft. mower, 2 horses	12	.8	1.7
Raking	June 10-June 25	10-ft. rake, 2 horses	10	1.0	2.0
Hauling	June 10-June 25	2 men, 2 horses and wagon	20	.5	1.0
			4	5.0	5.0

<sup>1</sup> See footnote <sup>2</sup> Table 2.

There are many other important considerations determining the amount of man labor and horse work needed in growing the different crops in western Kentucky. The timeliness of the different operations and the care with which they are performed are of extreme importance. Some farmers by so planning the work that each of the different operations can be done when it will mean most to the growing crop keep the labor requirements

Fig. 4.—Man labor and horse work used in producing mixed hay.<sup>1</sup>

<sup>1</sup> Man labor and horse work used in producing mixed hay and yield obtained in Christian County for the period 1921-23 inclusive.

Farm Number <sup>1</sup>	Total Acres Per Farm	Yield Per Acre (Tons)	Hours Per Acre		Hours Per Ton of Hay	
			Man	Horse	Man	Horse
5	88.6	1.3	10.5	8.6	7.9	6.5
14 <sup>2</sup>	95.0	1.4	13.4	12.3	9.7	8.9
7 <sup>3</sup>	13.5	.8	7.8	8.5	10.0	10.9
3	92.9	.7	7.9	9.4	11.1	13.3
1	116.6	.9	10.3	12.1	11.1	13.1
13	77.8	.7	7.7	8.1	11.6	12.1
11	163.3	.8	9.5	13.2	12.0	16.6
4	36.9	.9	11.4	9.7	12.5	10.5
6	90.0	.8	10.6	11.7	12.5	13.9
8 <sup>2</sup>	29.5	.9	11.6	16.8	12.9	18.7
2 <sup>2</sup>	37.4	.9	13.7	12.4	15.0	13.7
9 <sup>2</sup>	23.9	.7	10.7	11.0	15.0	15.4
12 <sup>3</sup>	35.1	.5	7.5	7.1	15.4	14.7
10	28.3	.7	11.6	10.4	17.7	15.9
Average		.9	10.2	11.1	11.2	12.1

<sup>1</sup> Farms are listed in order of man hours expended per ton of hay, beginning with the lowest.

<sup>2</sup> Includes only 1922 and 1923.

<sup>3</sup> Includes only 1921 and 1922.

low. Other farmers neglect essential operations from time to time so that additional labor is necessary in the end. For example, a small amount of work with the plow, hoe or spray at the most advantageous time may save double the work later for the same operations. Then, the neglect of such operations usually means reduced yields and lower quality. Especially is this true of delays during the planting and harvesting seasons. Some farmers use and are able to influence hired help to use a greater amount of care as they go about the farm work than do other farmers. This care usually is rewarded by increased yields and improved quality of product.

The variety of the crop grown, the size and shape of the fields, the distance of the fields from the barns are often important in determining the amounts of man labor and horse work used in producing a given quantity of a particular crop. Some varieties of a crop are usually better adapted to an area than other varieties. For most operations large fields rectangular in shape require less labor than small irregularly shaped fields. Often the farm layout is arranged so that much time is lost in going to and from work and in returning to the barns for repairs when breakdowns occur. A large number of farm to farm differences such as these help to explain why some farmers use almost twice as much man labor and horse work in growing a given quantity of a particular crop as do other farmers. Some are due to practices that may be improved immediately while other differences may require planning over a period of years.

It should be noted that farmers who used small amounts of man labor and horse work in getting a given quantity of one crop often used more in getting a given quantity of other crops. The farmer in this study who used the smallest amounts of labor in getting 40 bushels of corn and 12 bushels of wheat was among those who used large amounts of labor in getting 1,000 lbs. of tobacco. This suggests that an individual farmer may often use relatively more effective methods and practices for some crops than for other crops. This is in line with the common observation that one farmer is unusually successful with tobacco, another with corn, and others with other crops. It is

believed that most farmers will find it to their advantage to compare their own practices and results with those of their neighbors and with the standards suggested for these crops, and by this method try to find ways in which improvements may be made.

The economies that have been suggested in crop production are of two kinds, those that involve an increase in cash outlay, and those that do not involve an increase in cash outlay.

Decisions as to the selection of the particular crew and the kind and size of equipment often involve increased expenditures. In the tables suggesting the needs for different operations two or more crews are shown for many operations. Usually the larger crew means that less man labor will be needed and in most cases less horse work. It is realized that on a given farm an increase in the size of the crew will often mean new equipment and usually more expensive equipment.

In trying to decide whether or not it would pay to replace old equipment with new or with larger equipment at any given time the cost of making the exchange or the cost of new equipment, the length of time that the equipment would probably be used, the amount of man labor and horse work that would be saved, and the use to which this man labor and horse work would be put should be carefully considered. A labor saving practice during the rush seasons will mean more than the same savings during seasons when work is not so pressing. It will mean little to the farm profits to release man labor or horse work unless they can be utilized to good advantage at something else. On most farms in western Kentucky the busiest seasons are during May, June, and September. Often many essential operations are neglected during these months. A change in practices or equipment that would release labor during these months would likely result in a larger increase in profits than a similar change in December or January when there is less farm work that can be done.

The selection of the variety of crop to grow, the operation to be performed and the skill and timeliness in doing it usually do not involve increased expenditures. In selecting the

variety and the operation the farmer draws upon his own experience and the experiences of others, considers the season and the condition of the soil and crop at the particular time, and makes his decision. In deciding when to perform the different operations the urgency of the needs of two or more crop and live stock enterprises must be considered and attention given to the needs that are judged to be most urgent. In performing the different tasks the farmer often must decide between skill and speed and with a given rate of accomplishment as a standard use himself and encourage others to use as much care as possible.

In planning for improved practices "low requirements per unit of product" should not be confused with "small application per acre." Many of the improvements in methods and practices discussed make it possible to decrease the amount of man labor and horse work necessary to produce a given unit of product by causing an increase in yield per acre. As a rule the farmers who used small amounts of man labor and horse work per unit of product obtained relatively large yields per acre. In some cases a higher yield will necessitate a larger use of man labor, horse work, and materials per acre.

There is a point beyond which it will not pay to increase yields. However, in this study there was a tendency for farmers in using labor and materials on crops to stop short of the point at which the largest profits would have been obtained rather than to go beyond it. That is, in deciding upon the acreage of the different crops that could be grown most profitably with the man labor and horse work available most farmers were inclined to plan for an acreage too large rather than one too small. It usually pays to plant only such an acreage as can be cultivated thoroly and handled carefully. Especially is this true of the more intensive crops such as tobacco. Often farmers get large returns for the man labor, horse work and other resources used upon a small acreage of a crop planted at the most advantageous time, and cultivated thoroly and small returns for similar resources used upon another part of the same crop planted at a

less advantageous time, cultivated less thoroly and handled with less care.<sup>5</sup>

Farmers in planning for one crop must consider other crops. The soil and seasonal requirements of crops are such that usually several crops must be grown and one or more classes of livestock kept if the fertility of the soil is maintained and productive employment provided for the men and teams thruout the year. Generally the farmer will find it to his advantage to plan the system of farming around one, two, or in some cases three principal crop and livestock enterprises. These enterprises usually should be those for which the area and farm have superior natural advantages in comparison with other areas and farms.

To the major enterprises the farmer should add minor enterprises—crops and livestock that will help to keep up the fertility of the soil and that will utilize to good advantage the by-products, such as straw and stover from the crops and manure from the livestock, and provide profitable employment for the men and teams when they are not urgently needed by the major enterprises. It is expected that the cash returns for the man labor, horse work, and other resources used upon the major enterprises will be larger than the cash returns from such resources when used upon other crops and livestock. Yet the total returns from all resources will be larger if the minor enterprises are included, and it is this "total return" from all crops and livestock that one should keep in mind.

In trying to get the largest possible returns for the man labor, horse work, and other farm resources at hand the farmer must make decisions as to the kind and acreage of each crop to

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<sup>5</sup> The farmer in using his own labor, the labor of other members of the family, teams, and other resources that are definitely limited at a particular time, should try to apportion them among the different enterprises so as to get the largest possible returns. When he has decided upon the acreage, of a crop to grow he will find it advisable in using fertilizer and other materials purchased or labor hired for that crop to continue using them so long as the return resulting is more than its cost. That is, if the farmer is definitely limited as to the amount of any of the factors of production he should try to apportion all the factors so as to get the highest average returns from each unit of the limited factor. This will involve a comparison of the probable alternative returns from the fixed farm resources if used upon the different enterprises at a particular time, as well as a comparison of the probable returns from varying amounts of labor and material that can be bought at a particular time.

grow, the kind and number of each class of livestock to keep, and the methods and practices to use in growing each crop, and in handling each class of livestock. He will not find it advisable to make definite decisions regarding one part of this problem without considering the other parts. The selection of the methods to use in handling one crop will be influenced by the other crops that are needing attention at the same time, or the crop that is to follow, or the amount and kind of feed and pasturage needed, or all of these things and often others, combined. However, tentative decisions are made concerning many of these points independently of the others. In fact improvements in farming plans and practices are made usually after a careful study of a particular phase of the farming problem. It is hoped that the suggestions in this bulletin will be stimulating in the study of more effective methods and practices in growing crops.

## Appendix

Details of the labor and materials used on the farms discussed in the first part of the bulletin are presented in the following pages. Man labor and horse work for the different crops are shown, by operations, for 1923, and the totals of these items, together with the yields obtained, are shown for each of the years. The materials, such as seed, fertilizer, fuel and sprays used in producing tobacco and wheat also are shown. For corn and hay the materials were of minor importance and fairly uniform from farm to farm. All these data are expressed in physical quantities on the acre basis. A method of using such data in approximating costs is suggested.

### TOBACCO

*Man Labor and Horse Work Used in Producing Tobacco.* The hours of man labor and horse work used in producing dark-fired tobacco for the year 1923 are shown, by operations, in Table 12. The operations usually were performed in the order in which they are listed in this table, beginning at the left.

Plant beds generally were prepared in February or March and sown in March. They usually were covered with canvas at about the time the young plants came through the ground in early April. Most farmers prepared from 20 to 40 square yards of bed for each acre of ground planted to tobacco. Some of the beds were burned and some were steamed. Where brush or low-value wood are available, plant beds generally may be prepared more economically by burning. In other cases it is often advisable to steam. It usually requires from 2 to 5 hours more man labor to burn than it does to steam enough bed to plant an acre. However, this added labor is more than offset by the cost of coal and contract charge for the boiler and steaming box used in steaming. All these operations are included in the labor shown under plant bed in Table 12. The large amounts of labor used in preparing the plant beds on farms 1 and 3 were due mainly to the large plant area prepared. They each prepared from 40 to 50 square yards of plant bed for each acre of tobacco planted. The low expenditure of man labor and horse work for burning the beds on farm 7 was very largely the result of utilizing the easily obtained waste materials of the farm.

Plowing or breaking land for tobacco was done in the late fall or early spring, spring breaking being the most common. The three-horse team generally was used in performing this operation. Where the land was plowed in the fall, it was sometimes necessary to rebreak the following spring. This was largely responsible for the high labor re-

TABLE 12.—Hours Man Labor and Horse Work Used on Tobacco, By Operations, 1923  
(Acre Basis)

Farm No. <sup>1</sup>	Acres Per Farm	Yield (lbs.)	Acre Rate Per Acre (lbs.)	Plant Bed		Breaking		Disking		Harrowing		Laying Off Hilling and Fertilizing		Transplanting		
				Horse		Man		Horse		Man		Horse		Man		
				Hours	Times	Hours	Times	Hours	Times	Hours	Times	Hours	Times	Hours	Times	
1 <sup>2</sup>	23.3	1088	14.4 <sup>3</sup>	2.3	.7	7.7	.9	7.7	.7	2.0	.5	4.5	1.2	8.1	2.5	
2	13.3	848	13.4	4.9	14.6	2.1	8.4	1.8	1.1	2.3	1.0	1.4	2.7	11.4	2.7	
3	7.6	928	15.8 <sup>3</sup>	3.4	2.9	12.3	3.7	7.2	1.5	3.2	9.5	3.0	8.2	8.7	10.1	7.9
4	6.1	1124	7.9 <sup>3</sup>	.7	6.6	17.4	12.0	40.0	5.0	2.5	7.4	2.0	5.1	4.3	21.7	2.0
5	9.9	666	6.5 <sup>3</sup>	6.1	5.2	15.4	2.5	10.0	2.0	6.0	18.6	5.0	6.3	2.5	14.6	4.0
6	26.1	568	9.6	6.8	7.4	18.5	.6	2.4	.5	1.4	4.2	2.0	3.7	3.1	10.8	.5
7	9.3	702	12.3	8.2	7.4	17.9	1.9	7.8	1.0	1.3	5.2	2.0	10.2	3.0	12.1	6.6
8	15.7	492	9.2 <sup>3</sup>	1.9	5.1	10.2	3.7	11.9	2.0	1.0	3.0	1.0	7.8	1.8	10.3	2.5
9	12.5	570	1.3	5.9	4.8	9.6	7.0	17.5	2.4	1.1	2.2	1.0	4.0	3.3	18.9	1.0
10	8.8	757	16.1	15.3	6.5	19.6	4.0	15.9	2.5	1.1	4.5	1.0	8.0	16.5	16.1	2.5
11	12.4	717	13.2	6.6	13.2	3.8	12.3	2.0	.4	1.2	.5	18.8	2.8	15.5	2.2	2.2
12	10.5	553	20.3	4.4	4.1	12.2	4.9	19.5	2.8	1.0	3.8	1.2	24.0	5.9	17.2	2.4
13	13.0	738	11.4	4.3	6.0	14.9	3.5	11.7	1.9	1.6	4.9	1.6	8.3	4.4	13.7	2.7
<b>A.V.</b>																

<sup>1</sup>Farms are listed in order of man hours expended per 1,000 pounds tobacco during the three-year period 1921-1923, inclusive, beginning with the lowest.

<sup>2</sup>Used tractor for breaking and diskling part of land. Excluded from all averages except acres and yield.

<sup>3</sup>Plant beds steamed. The beds on the other farms were burned.

Table 12.—Hours Man Labor and Horse Work Used on Tobacco, By Operations, 1923—Continued.  
(Acre Basis)

Farm No. <sup>1</sup>	Plowing			Floeing			Top, Sucker, Worm and Spray			Cutting and Housing			Curing			Stripping			Marketing			Total Hrs. Per Acre			
	Man	Horses	Times	Man	Horses	Times	Man	Horses	Times	Man	Horses	Times	Man	Horses	Times	Man	Horses	Times	Man	Horses	Times				
1 <sup>2</sup>	16.7	17.1	.3 <sup>4</sup>	6.0 <sup>5</sup>	10.7	2.0	41.2	7	2	39.3	19.7	10.3	4.0	127.8	11.3	10.1	302.0	1.6	T						
2	11.3	15.6	2.5 <sup>4</sup>	4.4	1.0	34.2	7	3	21.8	7.5	34.2	9.6	113.9	7.2	8.7	264.0	69.4								
3	21.1	21.8	.5 <sup>4</sup>	15.1	2.3	49.7	8	1	46.2	33.4	41.7	18.2	83.6	6.6	6.6	315.8	121.1								
4	17.9	17.9	7.0 <sup>5</sup>	13.0	2.1	57.2	9	3	31.7	20.2	26.8	10.8	135.7	6.6	6.6	346.7	125.3								
6	20.4	20.4	7.0 <sup>5</sup>	17.6	2.4	58.1	9	2	29.3	18.0	20.4	5.0	61.8	5.1	5.1	257.8	101.1								
7	14.7	14.7	6.0 <sup>5</sup>	10.8	2.0	35.8	6	1	34.6	19.2	20.0	2.2	57.4	4.0	3.8	201.3	74.9								
8	19.0	19.0	6.0 <sup>5</sup>	10.9	1.7	52.5	8	2	28.2	20.0	40.0	4.3	60.3	8.2	4.5	270.9	89.9								
9	17.1	17.1	7.0 <sup>5</sup>	21.0	2.5	32.7	6		21.3	15.2	18.4	3.1	56.4	3.7	2.3	210.0	69.0								
10	17.7	17.7	7.0 <sup>5</sup>	12.9	2.0	51.5	8		31.0	14.6	18.6	3.4	53.3	3.2	8.0	230.9	77.6								
11	15.7	15.7	6.0 <sup>5</sup>	6.6	3	66.3	9	3	30.8	17.0	31.7	19.7	86.6	6.8	6.8	293.8	133.5								
12	12.5	12.5	5.0 <sup>5</sup>	20.0	2.2	39.9	6		20.8	10.4	29.1	5.2	64.6	5.7	5.7	253.1	63.3								
13	8.5	8.5	3.5 <sup>5</sup>	23.6	2.4	46.5	7	2	34.9	20.4	19.9	9.2	40.6	3.8	7.6	251.7	98.8								
Av.	15.5	16.0	5.8 <sup>5</sup>	13.6	1.9	44.6	7.2	1.5	29.6	17.1	23.7	6.8	69.6	5.2	5.6	249.0	86.8								

<sup>1</sup>Farms are listed in order of man hours expended per 1,000 pounds tobacco during the three-year period, 1921-1923, including, beginning with the lowest.<sup>2</sup>Used tractor for breaking and disking part of land. Excluded from all averages except acres and yield.<sup>3</sup>Two-horse plow.<sup>4</sup>One-horse plow.

quirements for breaking on farm 7. Land sometimes was disked before being plowed in the spring, but the most common practice was to follow the plow rather than precede it with the disk. The large amount of labor used in disking on farm 4 was due to the extremely thoro preparation that was given the tobacco land before transplanting. The thoroness of this preparation may to some extent account for the large yield that was obtained on this farm. The small amount of labor used on farm 7 left the soil in rather poor condition for transplanting the tobacco. This partly explains the low yield on this farm. The results obtained from disking and harrowing are often similar and to a limited extent one operation may be substituted for the other.

The amount of labor used in laying off, fertilizing and hillng was influenced to a large extent by the thoroness with which the disking and harrowing had been done. The large amounts of labor used on farms 8, 13 and 14 were due to the method used in performing this group of operations. On each of these farms the land was laid off with a one-horse turning plow and the hills were made with the hand hoe. Many successful tobacco growers do not consider such operations necessary if the disking and harrowing have been done thoroly. (See Table 12, page 404).

The location of the plant beds in the field in which a large part of the tobacco was planted on farm 1 largely accounts for the small amount of labor used in transplanting on that farm. The large amounts of labor used on farms 4, 10 and 14 were due partly to the distance of the beds from the tobacco field. All the tobacco grown on the farms in this study was transplanted by hand, a method almost universal in the area. Horse work reported under this operation was used for hauling plants or for hauling workmen to and from the field.

After the tobacco was planted plowing and hoeing were to an extent supplementary operations. Careful, thoro and timely work with the plow often reduced the amount of work necessary with the hoe. The large amounts of hoe labor performed on farms 9, 13 and 14 were for the most part made necessary because of neglected work with the plow shortly after the tobacco was transplanted.

The amount of labor used in topping, suckering, worming and spraying was influenced partly by the yield and partly by the amount of spray material used and the way in which it was applied. Variations in the amounts of labor used in cutting and housing are accounted for partly by the yield and partly by the distance from the tobacco field to the barn. However, there were many other important reasons for variations in these amounts. For example, the high labor requirements for cutting and housing on farm 3 were due to the small size of the crew that did the work.

The farm to farm differences in the amounts of labor used in curing were due largely to the distances that the wood was hauled, the size of the barn and the thoroughness with which the operation was performed. The quality of tobacco is so greatly influenced by the way in which the curing is done that it seldom pays to neglect this operation. However, a large amount of curing labor does not always mean that the operation has been thoroughly performed. Variations in the amounts of labor used in stripping are accounted for partly by differences in the yields that were obtained. Variations in the amounts of labor used in marketing were due partly to yield variations and partly to the distance from the farm to market.

The man labor and horse work used on all operations for tobacco during each of the years 1921, 1922 and 1923, together with the yields and prices obtained during those years are shown in Table 13. It will be observed that the amounts of man labor and horse work used per acre varied to some extent with the yield. For the year 1922 the relatively large amounts of man labor and horse work used and the relatively low yields obtained are explained partly by the exceptionally heavy damage by wildfire during that season.

*Materials and Equipment Used in Producing Tobacco.* The amounts and values of materials used in growing dark-fired tobacco on these farms in 1923 and 1922 are shown in Tables 14 and 15. The variations in amounts of coal used for plant beds were due partly to variations in the area of bed prepared per acre of tobacco and partly to the use of non-marketable fuel furnished by the farm. For example, in 1923 on farm 1 considerable wood was used along with the coal. The amounts of spray material used were influenced by the kind selected and the time and rate of application. The amounts of fertilizer used were influenced to some extent by the state of fertility of the soil and to a very considerable extent by the method of application practiced by the farm operator. Where more than 100 pounds of fertilizer were applied per acre it usually was broadcast. If less than 100 pounds were used the most common practice was to put it into the hill. The amount of wood used in curing usually varied with the yield of the crop, the size of the barn and the amount of firing done.

The values shown for the different materials were influenced by differences in quality and differences in price of the same quality. Whenever purchased materials were used within a reasonable length of time after having been bought actual cost prices have been used. The materials furnished by the farm were valued at the estimated farm price at the time they were used. In addition to the materials shown here it is necessary that barns, sticks, canvas, spray machines, tobacco knives and certain miscellaneous equipment be provided. Some kind of farm equipment was used, also, whenever horses were used. In-

TABLE 13.—Hours Man Labor and Horse Work Used on Tobacco, 1921, 1922 and 1923.  
(Acre Basis)

Farm No. <sup>1</sup>	Farms Per Acre	Acre Used Per Acre	1923			1922			1921			
			Total Hours Per Acre		Man	Acre Hours Per Acre		Man	Acre Hours Per Acre		Man	
			Man	Horse		Man	Horse		Man	Horse		
1 <sup>2</sup>	23.3	1088	1.6 T	81.6	\$0.20	41.2	581	199.0	4.1 T	\$0.16	34.6	
2	13.3	848	264.0	69.4	.16	17.6	881	229.0	78.9	.14	<sup>a</sup>	
3	7.6	928	315.8	121.1	.07	6.8	874	210.7	83.5	.12		
4	6.1	1124	346.7	125.3	.21	8.3	1041	342.7	109.4	.22		
5	<sup>a</sup>						12.1	887	294.5	104.8	.25	
6	9.9	666	257.8	101.1	.06	7.9	782	297.7	87.9	.17		
7	26.1	568	201.3	74.9	.11	19.7	688	220.3	75.1	.15		
8	9.2	792	270.9	89.9	.08	12.2	644	262.6	93.8	.12		
9	15.7	492	210.0	69.0	.08	14.0	656	234.4	73.1	.13		
10	12.4	570	230.9	77.6	.10	8.8	958	339.6	123.5	.14		
11	8.8	757	293.8	133.5	.06	19.5	750	330.3	107.8	.16		
12	<sup>a</sup>						10.7	985	386.6	.18		
13	12.5	717	253.1	63.3	.08	15.9	638	255.3	59.7	.16		
14	10.5	553	251.7	98.8	.10	13.3	647	258.4	96.5	.12		
Av.	13.0	738	249.0	86.8	\$0.12	14.7	740	276.4	88.2	\$0.16	13.0	
											893	
											256.9	
											85.1	
											\$0.18	

<sup>1</sup> Farms are listed in the same order as in Table 12 page 404.<sup>2</sup> Used tractor in preparing land for all crops. Not included in averages of man and horse hours.<sup>a</sup> No tobacco raised.

TABLE 14.—Materials Used in Producing Tobacco, 1923.  
(Acre Basis)

<sup>1</sup> Farms are listed in the same order as in Table 12, page 404.

brush, or other material considered to be worthless.

Plant beds all burned.

#### Beetle Moth. Sawdust

TABLE 15.—Materials Used in Producing Tobacco, 1922.  
(Acre Basis)

<sup>1</sup> Farms are listed in the same order as in Table 12, page 404.  
<sup>2</sup> Used wood, brush or other material considered to be worthless.

3 Plant beetle  
4 Beetle

• Killitone.  
• Sawdust.

terest, taxes, depreciation and insurance on this horse-drawn equipment usually amounted to 2 cents to 4 cents for each hour of horse work performed. The interest, taxes, depreciation and insurance on barns and sticks usually ranged from \$5.00 to \$8.00 per acre of tobacco grown. Other items were of minor importance, usually amounting to not more than \$1.00 to \$3.00 an acre.

*Calculating the Cost of Producing Tobacco.* Sometimes it is desirable to approximate rates for the different items entering into the production of farm commodities and work out cost statements. Such statements are often useful in comparing the efficiency of different farmers in producing a particular product. For this purpose completely extended cost statements are not necessary. Often when some of the minor costs are approximately equal to the value of the by-product work of this kind may be simplified by omitting both items. Common systems of rental also may be assumed. On this basis comparative tobacco cost statements are worked out for farms 1 and 14 for 1923. For the three-year period the number of hours of man labor and horse work used in producing 1,000 pounds of tobacco was lowest on farm 1 and highest on farm 14.

It is a common practice in western Kentucky for the grower of tobacco to give one-third of the crop for the use of the land, barns and sticks. In the statements that are presented one-third of the total yield is allowed for these items. A rate of 20 cents per hour is used for man labor and 15 cents per hour for horse work with equipment. The horse work rate has been assumed sufficiently high to cover the value of the use of horse-drawn equipment, approximately 12 cents per hour being allowed for horse work and 3 cents per hour for equipment. With these assumptions the costs of producing tobacco on these two farms in 1923 were as follows: (See Tables 12 and 14.)

## FARM 1.

Man labor 302 hrs. @ 20c	\$60.40
Horse work 81.6 hrs. @ 15c	12.24
Tractor work 1.6 hrs. @	
\$1.00	1.60
Coal for plant bed 1 bu	.20
Contract plant bed steaming	1.08
Spray material 10.3 lbs.	2.89
Fertilizer 160.9 lbs.	2.21
Wood for curing 1 ld.	.50
 Total these items per acre	 \$81.12
Total yield per acre	1,088 lbs.
Two-thirds per acre yield	725 lbs.
Cost per lb.: \$81.12 divided by 725 equals	11c

## FARM 14

Man labor 251.7 @ 20c.....	\$50.34
Horse work 98.8 hrs. @ 15c	14.82
No tractor work.	
No coal for plant bed.	
No steaming charge.	
Spray material 7.4 lbs.....	1.38
Fertilizer 188.4 lbs.....	2.34
Wood for curing 1 ld.....	.48
Total these items per	
acre .....	\$69.36
Total yield per acre.....	553 lbs.
Two-thirds per acre yield	369 lbs.
Cost per lb.: \$69.36 divided	
by 369 equals .....	19c

Thus, allowing one-third of crop for the use of land, barns and sticks, 20 cents per hour for man labor, and 15 cents per hour for horse work with equipment, the cost of producing tobacco on farm 1 in 1923 was 11 cents per pound. On farm 14 the cost was 19 cents per pound. The price received for the tobacco grown on farm 1 in that year was 20 cents per pound. (See Table 13.) The tobacco produced on farm 14 sold for 10 cents per pound. These prices may be said to represent to a reasonable degree the quality of the tobacco grown on the two farms. There is a wide difference between a cost of 19 cents with a price of 10 cents on farm 14 and a cost of 11 cents with a price of 20 cents on farm 1. These farms were within one mile of each other and the soils on which the tobacco was grown were about equal in fertility.

Some of the reasons for this difference are suggested in the following: Ample plant beds were prepared on both farms, but because of the more desirable location of the bed and better results obtained from the use of fertilizer the plants on farm 1 were ready to transplant about a week or ten days earlier than on farm 14. There was little difference in breaking, disking and harrowing the land on the two farms. It was thoroughly prepared in both instances. The fertilizer was applied to the tobacco fields in a similar manner and only slightly more per acre was used on farm 14. However, on farm 14 the land was laid off with a one-horse plow and hills made with a hand hoe, while on farm 1 the land was marked off with two- and three-row markers and no hills made. Thus about three times as much labor was used in laying off and hilling on farm 14 as in marking off on farm 1.

The plant beds were in the field in which most of the crop was planted on farm 1 and almost one mile away from the tobacco field on farm 14. The tobacco was transplanted about a week to ten days earlier on farm 1, replanted two times and practically a perfect stand secured, while, being transplanted later, it was replanted but one time on farm 14 and only a fair stand obtained. Partly because of the difference in distance from tobacco field to plant beds and partly as a result of faster work on farm 1 about 50 per cent more man labor and about three times as much horse work were used in transplanting an acre on farm 14 as on farm 1. In both cases the transplanting was done by hand, the teams being used to haul workmen and plants.

On farm 14 the tobacco was neglected for a time after transplanting so that a large amount of work with the hoe was necessary. On this farm none of the tobacco was cultivated with the plow more than four and some of it only three times. On farm 1 a small harrow was used shortly after transplanting, and all the tobacco cultivated six and some of it seven times with the plow and harrow. Consequently a much smaller amount of labor was necessary with the hoe. A more liberal and timely use of spray materials helped to keep the labor requirements in

worming lower on farm 1. The difference in the amounts of labor used for the combined operations of topping, worming, suckering and spraying is significant when the size of the tobacco on the two farms, as revealed in the yields, is considered. In cutting and housing only slightly more effective work was done on farm 1, taking into account the yields. The curing was poorly done on farm 14. In the beginning the work was delayed too long so that unusually careful firing was necessary.

The yield per acre was almost twice as large on farm 1 as on farm 14. The differences in the operations before the topping season largely account for the difference in yields. These operations, together with differences in later operations, particularly curing, account for the difference in quality. The larger labor requirement per unit of product on farm 14 was further influenced by the large amounts of labor devoted to operations not essential for good yields and high quality.

#### CORN

*Man Labor and Horse Work Used in Producing Corn.* The hours of man labor and horse work used in preparing the land and cultivating corn, in 1923, are shown, by operations, in Table 16. The operations usually were performed in the order in which they are listed in this table, beginning at the left.

Practically all breaking for corn was done in the early spring. About half the area planted to corn on farm 7 was plowed twice in the spring of 1923. This accounts for the large amounts of man labor and horse work shown for breaking on that farm. Disking and harrowing were performed at about the same time and often one was substituted for the other. The large amounts of man labor and horse work devoted to these two operations of farms 11, 2 and 10 were due largely to the thoro preparation given the land before planting. This was reflected to a considerable extent in the yields obtained on these farms. Likewise the small amounts of man labor and horse work devoted to these operations on farm 9 partly account for the low yield on that farm.

The total hours of man labor and horse work used in preparing the land and cultivating corn on the different farms in 1922 and 1923, together with the yields obtained, are shown in Table 17. It will be observed that slightly more of these items were used in 1922 than in 1923. The year 1922 was a better season for corn cultivation in this area than 1923, which fact also goes far toward explaining the higher yields obtained in that year.

On the farms studied about two-thirds of the corn was snapped from the standing stalk, the remainder being cut and husked from the

TABLE 16.—Hours Man Labor and Horse Work Used on Corn Prior to Harvest, By Operations, 1923.  
(Acre Basis)

Farm No. <sup>1</sup>	Acres Per Farm	Breaking		Disking		Harrowing		Planting		Hoeing		Cultivating With Plow		Total Hours Per Acre		
		Man	Horse	Man	Horse	Man	Horse	Man	Horse	Man	Horse	Man	Horse	Man	Horse	
11	58.8	46.6	5.5	16.6	2.4	9.6	2.0	.6	2.6	2.0	.9	1.8	2.1	4.1	8.2	3.5 <sup>2</sup>
1 <sup>3</sup>	170.9	31.8	3.2	5.9	.5	.85T	.43T	.7	1.1	2.0	1.3	2.0	2.1	5.5 <sup>4</sup>	9.0	3.0 <sup>2</sup>
2	24.5	30.6	4.9	14.6	3.3	11.9	2.4	1.1	2.2	1.6	.8	1.6	5.5 <sup>4</sup>	11.0	4.0 <sup>2</sup>	13.3 18.2
14	128.2	33.1	4.1	12.2	1.1	4.4	1.0	.3	1.3	1.0	.8	1.3	.6	4.4	8.4	.2 <sup>5</sup>
5	33.7	34.8	4.5	13.5	2.7	10.6	2.1	.4	1.0	1.0	.1	2.2	1.3	3.9 <sup>4</sup>	8.4	3.0 <sup>2</sup>
6	29.2	36.0	4.3	12.8	2.0	8.0	2.0	1.0	2.8	1.7	.8	1.6	.8	2.8	5.6	2.5 <sup>2</sup>
8	38.9	25.7	4.0	11.8	1.1	4.4	1.9	1.7	5.4	3.0	1.1	2.1	1.0	4.2	8.4	3.0 <sup>2</sup>
3	49.6	15.7	2.9	12.3	1.1	2.7	.7	1.5	4.4	3.0	.8	1.5 <sup>4</sup>	.8	3.8 <sup>4</sup>	7.8	3.5 <sup>2</sup>
4	21.1	21.3	4.7	14.1	1.7	6.0	1.0	.7	.7	1.4	.4	3.4	5.8 <sup>4</sup>	11.4	3.5 <sup>2</sup>	10.1 28.7
13	26.2	25.8	5.6	11.2	1.9	5.8	1.0	.7	.7	1.3	.3	1.8	11.0 <sup>4</sup>	12.9	3.3 <sup>2</sup>	11.3 30.8
10	33.0	23.3	5.4	10.9	1.5	4.2	1.0	1.5	3.3	1.8	.7	1.4	2.6	6.8	10.6	3.0 <sup>2</sup>
9	31.7	14.8	6.8	13.6	.6	2.1	.5	1.2	3.5	1.8	1.0	2.0	1.3	7.9	11.2	1.5 <sup>2</sup>
7 <sup>4</sup>	20.3	25.9	8.7	23.1	2.3	8.8	2.0	.8	2.3	1.5	1.4	2.8	13.8	19.2	2.0 <sup>2</sup>	13.9 35.7
Av.	51.2	30.1	4.6	13.1	1.6	6.0	1.1	.8	2.4	1.7	.9	1.7	1.1	4.8	8.8	.6 <sup>5</sup>

<sup>1</sup> Farms listed in order of man hours expended per 40 bushels corn, during the years 1922 and 1923, beginning with the lowest.

<sup>2</sup> Two-horse plow.

<sup>3</sup> Used tractor in preparing ground for planting. Not included in averages of man and horse hours.

<sup>4</sup> Includes small amount of work done with roller or section harrow.

<sup>5</sup> One-horse plow.

<sup>6</sup> Replanting.

<sup>7</sup> Rebroke over half of the area planted. Not included in averages of man and horse hours.

TABLE 17.—Hours Man Labor and Horse Work Used on Corn Prior to Harvest, 1923 and 1922.  
(Acre Basis)

Farm No. <sup>1</sup>	Acres Per Farm	1923				1922			
		Yield Per Acre (Bush.)	Man	Total Hours Per Acre		Acres Per Farm	Yield Per Acre (Bush.)	Total Hours Per Acre	
				Horse	Man			Man	Horse
11	58.8	46.6	15.6	38.8	24.7	54.7	18.5	49.4	.88 T
1 <sup>2</sup>	170.9	31.8	13.3	18.2	92.9	51.9	13.0	25.9	
2	24.5	30.6	15.6	41.3	51.0	51.6	13.4	35.1	
14	128.2	33.1	12.0	27.6	116.7	48.9	12.0	30.4	
5	33.7	34.8	13.9	35.7	36.3	44.3	14.1	33.7	
6	29.2	36.0	11.3	30.8	24.7	53.3	16.6	43.6	
8	38.9	25.7	13.1	32.1	20.0	28.1	16.3	36.4	
3	49.6	15.7	10.1	28.7	83.9	30.1	13.2	33.2	
4	21.1	21.3	16.3	32.9	17.8	44.2	20.1	31.8	
13	26.2	25.8	22.9	31.7	33.4	37.7	25.0	35.4	
10	33.0	23.3	19.6	30.4	28.3	19.3	23.3	43.7	
9	31.7	14.8	19.0	32.4	10.2	32.2	21.2	32.0	
7 <sup>3</sup>	20.3	25.9	27.0	56.2	16.7	19.2	23.3	36.9	
Average	51.2	30.1	14.2	32.0	42.7	15.9	35.1		

<sup>1</sup> Farms are listed in the same order as in Table 16, page 414.

<sup>2</sup> Used tractor in preparing land for both crops. Not included in averages of man and horse hours.

<sup>3</sup> Rebroke over half of ground for 1923 crop. Not included in averages of hours during that year.

TABLE 18.—Hours Man Labor and Horse Work Used in Harvesting<sup>1</sup> Cut and Shocked Corn, 1922, 1923.  
(Acre Basis)

Farm No. <sup>2</sup>	Acres Per Farm	1923			1922			Contract Cutting Per Acre		
		Yield Per Acre (Bush.)		Total Hours Per Acre	Contract Cutting Per Acre		Acres Per Farm	Yield Per Acre (Bush.)	Total Hours Per Acre	Contract Cutting Per Acre
		Man	Horse					Man	Horse	
11	23.7	46.6	9.0	12.7	\$1.87					
1	76.0	31.8	10.3	3.7	.52		39.4	51.9	18.2	7.6
2	14.0	30.6	11.4	7.1	1.50		40.5	51.6	13.0	6.7
14	12.7	39.4	12.4	8.1	1.26		25.0	54.5	13.0	\$1.63
5	5.3	34.8	14.1	7.5	1.38		8.2	44.3	9.2	1.44
6	29.2	36.0	11.6	10.5	1.71		24.7	53.3	15.4	4.3
3	<sup>3</sup>									1.46
4	3.0	21.3	8.3	3.3	1.53		30.0	32.3	11.5	2.49
9	3.7	28.4	12.3	10.3	1.02		13.3	47.3	12.8	5.8
7 <sup>4</sup>	12.1	25.9	8.3	8.3	<sup>3</sup>		3.5	17.1	6.0	1.92
Average	20.0	34.3	10.7	7.0	1.12		23.1	47.9	14.1	7.1
										1.09

<sup>1</sup> Harvesting, as here used, includes labor for cutting, shocking, hauling, and cribbing. Farms are listed in order of man hours expended per 40 bushels corn during the years 1922 and 1923, beginning with the lowest.

<sup>2</sup> No corn out.

<sup>4</sup> Crop share-cut in 1923. Excluded from all averages except acres and yield for that year.

TABLE 19.—Hours Man Labor and Horse Work Used in Harvesting<sup>1</sup> Snapped Corn, 1922, 1923.  
(Acre Basis)

Farm No. <sup>2</sup>	1923				1922			
	Acres Per Farm	Yield Per Acre (Bus.)	Total Hours Per Acre		Acres Per Farm	Yield Per Acre (Bus.)	Total Hours Per Acre	
			Man	Horse			Man	Horse
11	35.1	46.6	7.0	14.4	24.7	54.7	8.9	12.3
1	94.9	31.8	3.2	2.3	53.5	51.9	12.2	7.6
2	10.5	30.6	5.7	3.8	10.5	51.6	11.4	6.5
14	115.5	32.4	10.8	8.1	91.7	47.3	11.8	6.8
5	28.4	34.8	10.4	8.1	28.1	44.3	9.2	4.3
8	38.9	25.7	6.2	3.8	20.0	28.1	7.2	6.2
3	49.6	15.7	5.4	5.0	53.9	28.9	9.4	5.6
4	18.1	21.3	8.2	3.3	4.5	35.0	10.9	6.7
13	26.2	25.8	7.4	7.6	33.4	37.7	3.8	3.2
10	33.0	23.3	7.0	6.0	28.3	19.3	5.4	9.7
9	28.0	13.0	8.7	10.0	10.2	32.2	6.7	12.5
7	8.2	25.9	5.8	7.3	13.2	19.7	10.0	4.4
Average	39.0	28.6	7.3	6.4	31.0	40.1	9.4	6.8

<sup>1</sup> Harvesting, as here used, includes all labor connected with pulling, hauling and cribbing.

<sup>2</sup> Farms are listed in order of man hours expended per 40 bushels corn during the years 1922 and 1923, beginning with the lowest.

shock. Man labor and horse work used in harvesting cut and shocked corn in 1922 and 1923 are shown in Table 18. In most cases part or all of the cutting and shocking was done on the contract basis. In 1923 about three-fifths of the corn cut was handled in this way, and a slightly less amount was cut by contract in 1922. The labor shown in Table 18 includes that part of the cutting and shocking done by the regular farm labor and all the labor for husking and hauling, but does not include hauling the stover. The man labor and horse work used in harvesting snapped corn in 1922 and 1923 are shown in Table 19. The larger amounts of labor used in 1922 were due mainly to the larger yields of that year.

*Materials and Equipment Used in Producing Corn.* The materials used in producing corn were relatively unimportant. One bushel of seed corn usually planted 6 to 8 acres. On farm 10 of this study a light application of fertilizer was used on corn in both the years, 1922 and 1923, and on farm 14 a small amount was used in 1922. No fertilizer was used on any of the other farms. Interest, taxes, depreciation and insurance on horse-drawn equipment usually amounted to 2 cents to 4 cents for each hour of horse work used in producing corn.

*Calculating the Cost of Producing Corn.* Cost statements similar to those presented for tobacco are worked out for corn. As in the case of tobacco one-third of the crop often is given for the use of the land. In the tables showing man labor and horse work used on corn the hours devoted to planting and cultivating have been kept separate from those spent in harvesting. In calculating the total cost of producing the crop it will be necessary to bring together the totals shown in Tables 17 and 18, if the cost of cut and shocked corn is desired, or the totals from Tables 17 and 19 if the cost of snapped corn is wanted. In the following illustration the totals from Tables 17 and 19 have been brought together and the cost of corn snapped from the standing stalk computed for farms 11 and 7 in 1923.

#### FARM 11

Man labor 22.6 hrs. @ 20c	\$4.52
Horse work 43.2 hrs. @ 15c	6.48
Seed 1/6 bu. @ \$1.20.....	.20
Total these items .....	\$11.20
Total yield per acre .....	46.6 bus.
Two-thirds per acre yield.....	31.1 bus.
Cost per bushel: \$11.20 di- vided by 31.1 equals.....	36c

#### FARM 7

Man labor 32.8 hrs. @ 20c...	\$6.56
Horse work 65.5 hrs. @ 15c	9.82
Seed 1/6 bu. @ \$1.20.....	.20
Total these items .....	\$16.58
Total yield per acre.....	25.9 bus.
Two-thirds per acre yield.....	17.3 bus.
Cost per bushel: \$16.58 di- vided by 17.3 equals .....	96c

Thus, allowing one-third of the crop for the use of the land, 20 cents per hour for man labor, 15 cents per hour for horse work and equipment use and \$1.20 per bushel for seed, the cost of producing corn on farm 11 in 1923 was 36 cents per bushel while on farm 7 the cost

was 96 cents per bushel. By using the same rates for man labor and horse work, allowing the same price for seed corn and giving one-half the crop for the use of the land, the cost on farm 11 was about 48 cents per bushel and on farm 7 about \$1.28 per bushel.

The difference in costs was largely the result of the lower yield and the larger amounts of man labor and horse work used per acre on farm 7. It appears that the difference in yields was partly, though not wholly, due to differences in the fertility of the fields in which the corn was produced on the two farms. The land planted to corn on farm 11 had not been cropped so continuously and was in a higher state of fertility than the land planted to corn on farm 7.

On farm 7 some of the land was broken when it was too wet to pulverize easily and altho a normal amount of work was done with the disk, harrow and drag, the soil was in poor physical condition when the crop was planted. As a result about one-half the area planted on farm 7 was rebroken and planted a second time. The fields were smaller and less regular in shape on farm 7 than on farm 11. On farm 11 the corn was cultivated entirely with a two-horse cultivator, while on farm 7 about one-half the work in cultivating was done with a one-horse plow. Higher labor expenditures per acre and lower yields result in higher labor requirements and increased costs per unit of product.

## WHEAT

*Man Labor and Horse Work Used in Producing Wheat.* The man labor and horse work used in preparing the land and seeding wheat, in 1923, are shown, by operations, in Table 20. The larger part of this wheat was sown after cultivated crops, usually corn or tobacco. In 1923 some of the land was plowed for wheat on about one-half of the farms. Of the total area planted about one-third was broken and two-thirds seeded after cultivated crops. Owing to crop failures and the desirability of having a nurse crop for clover some land is plowed for wheat every year in all areas in which the conditions and type of farming are similar to those on the farms studied. Practically the same amount of disking, dragging and harrowing is necessary in planting wheat on fallowed land as in planting after cultivated crops.

The total hours of man labor and horse work used in preparing the land and seeding wheat in 1921, 1922 and 1923 are shown in Table 21. The data in this table indicate that the yields were slightly larger for those years during which the larger amounts of man labor and horse work were used in preparing the land for the crop. This is not only reflected in the averages for the different years but also in the data for a large number of the individual farms.

TABLE 20.—Hours Man Labor and Horse Work Used on Wheat Prior to Harvest, by Operations, 1923.  
(Acre Basis)

Farm No. <sup>1</sup>	Acre <sup>2</sup> s Farmed	Yield Per Bushel	Breaking <sup>2</sup>			Disking			Dragging & Harrowing			Total Hours Per Acre				
			Man		Horse	Times Over		Man	Man		Horse	Man		Horse		
			Man	Horse	Times Over	Man	Horse	Times Over	Man	Horse	Man	Man	Horse	Horse		
11	44.2	15.7				3.5	13.8	3.0				2.1	1.6	3.2	7.2	17.0
1 <sup>3</sup>	76.0	9.7	.3	.9	.12	.4	.4 T		1.0	1.1	4.3	.1	1.2	2.8	3.1	8.0
8	20.3	13.2				1.1	3.7		.8	.5	1.1	1.1	1.2	2.5	2.8	7.2
14	92.3	13.7	2.0	6.0	.5	2.7	10.8		2.0	.1	.4	.2	1.2	2.4	6.2	19.7
5	34.6	20.2	2.6	7.5	.5	1.8	6.5		1.3	1.4	4.0	1.3	1.4	2.9	8.5	20.9
2	44.1	4.5				2.6	7.5		1.5	6.2	1.2	.2	1.2	2.4	2.9	8.6
6	52.4	5.5				7.5	.5		1.2	5.0	1.0	.7	2.4	1.2	3.5	18.4
13	20.2	9.4							2.0	5.9	1.1			1.0	3.0	8.9
3	77.0	7.1	3.0	9.8	.7	.3	1.3		1.2	4.0	1.2	.7	1.0	2.6	6.7	17.7
Av.	51.2	10.6	1.6	5.1	.3	1.8	6.9		1.4	.5	1.7	.7	1.2	2.7	5.8	16.4

<sup>1</sup> Farms are listed in order of man hours expended per 12 bushels wheat, during the three-year period 1921-23, inclusive, beginning with the lowest.

<sup>2</sup> Expressed on total acre basis.

<sup>3</sup> Used tractor for disking. Not included in averages of man and horse hours.

Table 21.—Hours Man Labor and Horse Work Used on Wheat Used on Wheat Prior to Harvest, 1923, 1922 and 1921.  
(Acre Basis)

Farm No. <sup>1</sup>	1923				1922				1921			
	Farms Per Acre	Total Hours Per Acre		Acres Per Farm	Farms Per Acre	Total Hours Per Acre		Acres Per Farm	Farms Per Acre	Total Hours Per Acre		Acres Per Farm
		Man	Horse			Yield (Bus.)	Acres Per Field			Yield (Bus.)	Acres Per Field	
11	44.2	15.7	7.2	17.0	51.5	9.7	4.4	11.0	55.6	7.5	2.8	6.8
1 <sup>2</sup>	76.0	9.7	3.1	8.0	95.0	10.3	2.4	6.5	78.0	10.2	4.5	10.8
8	20.3	13.2	2.8	7.2	33.2	12.8	4.3	14.1	20.3	14.1	3.3	9.8
14	92.3	13.7	6.2	19.7	92.8	9.9	5.4	17.3	<sup>3</sup>	<sup>3</sup>	<sup>3</sup>	<sup>3</sup>
5 <sup>4</sup>	34.6	20.2	8.5	20.9	32.7	13.9	8.0	22.0	32.7	7.3	5.4	14.7
2	44.1	4.5	2.9	8.6	72.9	8.4	2.2	8.9	<sup>3</sup>	<sup>3</sup>	<sup>3</sup>	<sup>3</sup>
6	52.4	5.5	5.6	18.4	47.6	9.3	6.0	19.2	33.7	8.3	2.2	6.5
13	20.2	9.4	3.0	8.9	21.7	7.0	3.8	11.5	12.0	5.5	20.2	<sup>3</sup>
3	77.0	7.1	6.7	17.7	100.9	11.9	11.6	36.1	95.2	8.9	8.0	25.0
12	<sup>3</sup>	<sup>3</sup>	<sup>3</sup>	<sup>3</sup>	15.6	7.9	8.0	20.1	19.1	8.3	6.0	14.9
Av.	51.2	10.6	5.8	16.4	56.4	10.3	5.6	17.3	43.2	9.1	5.1	14.4

<sup>1</sup> Farms are listed in the same order as in Table 20, page 420.

<sup>2</sup> Used tractor in preparing 1923 seed bed. Not included in average of hours for that year.

<sup>3</sup> No wheat raised.

<sup>4</sup> Used tractor in preparing 1921 seed bed. Not included in average of hours for that year.

Table 22.—Hours Man Labor and Horse Work Used in Harvesting<sup>1</sup> and Marketing Wheat, by Operations, 1923.  
(Acre Basis)

Farm No. <sup>2</sup>	Farm Per Acres	Yield Per Acre Bns.	Cutting		Shocking		Threshing		Marketing		Total Hours Per Acre		Hours per bushel
			Man	Horse	Man	Horse	Man	Horse	Man	Horse	Man	Horse	
11 <sup>3</sup>	44.2	15.7	1.3	5.2	.3 <sup>4</sup>	1.9			.5	2.2	4.0	7.4	\$0.20
1 <sup>5</sup>	76.0	9.7	1.0	.35 T	1.2	1.2	2.0		.3	.8	4.5	.35 T	.10
8	20.3	13.2	2.2	4.3	1.9	4.4	4.1		1.0	2.0	9.5	10.4	.11
14	92.3	13.7	.5	2.0	1.3	1.3	1.2		1.8	3.2	5.2	6.4	.10
5	34.6	20.2	.9	3.4	.2 <sup>4</sup>	2.2	3.0		.3	.6	6.6	6.3	.08
2	44.1	4.5	.8	3.0	1.8	1.5	3.1		1.4	2.5	5.6	8.6	.10
6	52.4	5.5	.6	2.5	1.8	1.3	1.8		1.2	2.1	4.9	6.4	.10
13	20.2	9.4	1.8	3.6	1.6	2.2	2.2		1.0	2.0	6.6	7.8	.10
3	77.0	7.1	.7	2.6	1.2 <sup>4</sup>	.8	1.1		1.0	1.0	4.0	4.7	.10
Av.	51.2	10.6	.8	2.7	1.6	1.6	1.8		1.2	2.0	5.4	6.5	\$0.10

<sup>1</sup> Harvesting, as here used, includes the labor on cutting, shocking and threshing the crop.<sup>2</sup> Farms are listed in order of man hours expended per 12 bushels wheat during the three-year period 1921-23, inclusive, beginning with the lowest.<sup>3</sup> Furnished no labor for threshing. Excluded from the averages of hours and threshing costs.<sup>4</sup> Reshocking.<sup>5</sup> Used tractor for cutting part of the acreage. Not included in averages of man and horse hours.

TABLE 23.—Hours Man Labor and Horse Work Used in Harvesting<sup>1</sup> and Marketing Wheat, 1923, 1922 and 1921  
(Acre Basis)

Farm No. <sup>2</sup>	Farms Per	1923				1922				1921					
		Total Hours Per Acre		Cost of Threshing		Total Hours Per Acre		Cost of Threshing		Total Hours Per Acre		Cost of Threshing			
		Man	Horse	Acres Per	Bushels	Man	Horse	Acres Per	Bushels	Man	Horse	Acres Per	Bushels		
11 <sup>3</sup>	44.2	15.7	4.0	7.4	\$0.20	51.5	9.7	3.6	5.9	\$0.19	55.6	7.5	2.3		
1 <sup>4</sup>	76.0	9.7	4.5	4.0	.35 T	.10	95.0	10.3	5.4	.21 T	.08	78.0	10.2	.50	
8	20.3	13.2	9.5	10.4		.11	33.2	12.8	8.2	10.2	.10	20.3	14.1	6.8	
14 <sup>5</sup>	92.3	13.7	5.2	6.4		.10	92.8	9.9	4.2	3.8	.16	6	10.5	.10	
5	34.6	20.2	6.6	6.3		.08	32.7	13.9	8.2	6.2	.09	32.7	7.3	.10	
2	44.1	4.5	5.6	8.6		.10	72.9	8.4	5.2	6.6	.09	6	10.0	.10	
6 <sup>7</sup>	52.4	5.5	4.9	6.4		.10	47.6	9.3	5.4	8.5	.09	33.7	8.3	.55	
13	20.2	9.4	6.6	7.8		.10	21.7	7.0	10.9	13.9	.12	11.0	12.0	.20	
3	77.0	7.1	4.0	4.7		.10	100.9	11.9	6.9	8.0	.10	95.2	8.9	.10	
12								15.6	7.9	5.8	8.3	.10	19.1	8.3	.11
Av.	51.2	10.6	5.4	6.5		\$0.10	56.4	10.3	6.8	8.2	\$0.09	43.2	9.1	.10	

<sup>1</sup> Harvesting, as here used, includes the labor on cutting, shocking and threshing the crop.<sup>2</sup> Farms are listed in the same order as in Table 22, page 422.<sup>3</sup> Furnished no labor for threshing during either year. Excluded from all averages of hours and threshing costs.<sup>4</sup> Used tractor for cutting part of the acreage in 1923 and 1922. Not included in averages of hours for those years.<sup>5</sup> Furnished no labor for threshing in 1922. Not included in averages of hours or threshing costs for that year.<sup>6</sup> No wheat raised.<sup>7</sup> Furnished no labor for threshing in 1921. Not included in averages of hours or threshing costs for that year.

TABLE 24.—Hours Man Labor and Horse Work Used in Producing Wheat, 1923, 1922 and 1921.  
(Acre Basis)

Farm No. <sup>1</sup>	1923			1922			1921		
	Acres Per Farm	Yield Per Acre	Total Hours Per Acre	Acres Per Farm	Yield Per Acre	Total Hours Per Acre	Acres Per Farm	Yield Per Acre	Total Hours Per Acre
11 <sup>2</sup>	44.2	15.7	112.244	51.5	9.7	8.0	16.9	\$0.19	55.6
1 <sup>3</sup>	76.0	9.7	7.612.0	.10	95.0	10.3	.21 T	.08	78.0
8	20.3	13.2	12.317.6	.11	33.2	12.8	12.524.3	.10	20.3
14 <sup>4</sup>	92.3	13.7	11.426.1	.10	92.8	9.9	9.621.1	.16	14.1
5 <sup>5</sup>	34.6	20.2	15.127.2	.08	32.7	13.9	16.228.2	.09	32.7
2	44.1	4.5	8.517.2	.10	72.9	8.4	7.415.5	.09	6
6 <sup>7</sup>	52.4	5.5	10.524.8	.10	47.6	9.3	11.427.7	.09	33.7
13	20.2	9.4	9.616.7	.10	21.7	7.0	14.725.4	.12	11.0
3	77.0	7.1	10.722.4	.10	100.9	11.9	18.544.1	.10	95.2
12	51.2	10.6	11.022.9	\$0.10	15.6	7.9	13.828.4	.10	8.9
Av.					56.4	10.3	13.629.6	\$0.09	43.2

<sup>1</sup> Farms are listed in order of man hours expended per 12 bushels wheat during the three-year period, 1921-23, inclusive, beginning with the lowest.

<sup>2</sup> Furnished no labor for threshing during any year. Excluded from all averages of hours and threshing costs.

<sup>3</sup> Used tractor on 1923 and 1922 crops. Not included in averages of hours for those years.

<sup>4</sup> Furnished no labor for threshing in 1922. Not included in averages of hours or threshing costs for that year.

<sup>5</sup> Used tractor in preparing 1921 seed bed. Not included in average of hours for that year.

<sup>6</sup> No wheat raised.

<sup>7</sup> Furnished no labor for threshing in 1921. Not included in averages of hours or threshing cost for that year.

The hours of man labor and horse work used in harvesting and marketing wheat, in 1923, are shown, by operations, in Table 22. This table includes all man labor and horse work used in cutting, shocking and hauling the bundled grain to the thresher and hauling the threshed grain to market for all farms except farm 11. On farm 11 the threshing crew contracted to thresh the crop from the shock and the farmer furnished no labor in hauling the bundled grain to the machine. Variations in the per bushel contract charge for threshing in 1923 on farms other than 11 were due largely to differences in yield, this charge generally being relatively less for a heavy yielding crop than for a light yielding one.

The total hours of man labor and horse work used in harvesting and marketing wheat in 1921, 1922 and 1923 are shown in Table 23. The relatively high labor requirements per acre in 1922 as compared with 1923 were due partly to the slightly higher yields obtained in 1922. The higher labor requirements in 1921 over both 1922 and 1923, in spite of the lower yields of that year, are explained partly by the relatively heavy straw and light grain yield on some the farms in 1921.

The total hours of man labor and horse work used in growing, harvesting and marketing wheat for the years 1921, 1922 and 1923 are shown in Table 24. This table is made by combining the totals from Tables 21 and 23 and is constructed on the same basis.

*Materials and Equipment Used in Producing Wheat.* The materials used in producing wheat for the years 1923 and 1922 are shown in Tables 25 and 26. The fertilizer practices from farm to farm had little in common. In fact the practices from year to year were not uniform, even on the same farm. Variations in the amounts of twine used in harvesting and coal for threshing were due partly to yield differences and partly to the relative weights of grain and straw on the different farms. The contract charge for threshing is shown with the man labor and horse work in Table 24. Interest, taxes, depreciation and insurance on the equipment used on wheat were important items of expense. The charge for these items usually ranged from 5 cents to 8 cents for each hour of horse work used.

*Calculating the Cost of Producing Wheat.* Cost statements similar to those shown for corn and tobacco are worked out for wheat. In this area wheat is grown as a nurse crop for clover and other hay crops and for the straw made available for use by livestock, as well as for cash returns made by the grain. Because of the relation of the crop to the other farm enterprises and the place that it fills in the cropping system no land charge has been made in computing the cost of producing wheat. In excluding this charge it has been assumed that in this area the value of the wheat as a nurse crop and the value of the straw for livestock offset the value of the use of the land. In the statements for

TABLE 25.—Materials Used in Producing Wheat, 1923.  
(Acre Basis)

Farm No. <sup>1</sup>	Acres Per Farm	Yield Per Acre (Bush.)	Seed		Fertilizer		Twine		Coal to Thresh	
			Bushels	Value	Pounds	Value	Pounds	Value	Bushels	Value
11	44.2	15.7	1.7	\$2.12	226.0	\$1.74	2.3	\$0.24	<sup>2</sup>	
1	76.0	9.8	1.4	1.66	40.0	.60	1.0	.13	.46	\$0.09
8	20.3	13.2	1.5	1.84	147.0	2.21	2.5	.30	.74	.15
14	92.3	13.7	1.1	1.35	43.3	.32	2.2	.23	.56	.10
5	34.6	20.2	1.2	1.73	202.3	1.52	2.2	.22	.87	.15
2	44.1	4.5	1.0	1.28			1.1	.13	.45	.09
6	52.4	5.5	1.3	1.57			1.9	.21	.76	.14
13	20.2	9.4	1.0	1.20	100.0	2.12	1.5	.17	.74	.14
3	77.0	7.1	1.0	1.22	77.9	.91	1.0	.11	.42	.07

<sup>1</sup> Farms are listed in order of man hours expended per 12 bushels wheat during the three-year period, 1921-23, inclusive, beginning with the lowest.

<sup>2</sup> Coal furnished by company that did threshing.

TABLE 26.—Materials Used in Producing Wheat, 1922.  
(Acre Basis)

Farm No. <sup>1</sup>	Acres Per Farm	Yield Per Acre (Bush.)	Seed		Fertilizer		Twine		Coal to Thresh	
			Bushels	Value	Pounds	Value	Pounds	Value	Bushels	Value
11	51.5	9.7		\$2.19					1.1	\$0.12
1	95.0	10.3	1.6	1.55	84.2	\$0.97	1.2	.15	.68	\$0.13
8	33.2	12.8	1.3	1.72	135.5	3.05	1.9	.24	.75	.15
14	92.8	9.9	1.5	1.82			2.7	.34	.81	.15
5	32.7	13.9	1.2	1.57	244.6	2.15	2.1	.27	.92	.16
2	72.9	8.4	1.0	1.23			1.2	.15	.82	.16
6	47.6	9.3	1.3	1.57	65.6	.64	1.3	.16	.93	.18
13	21.7	7.0	1.2	1.05	73.7	1.45	1.6	.19	<sup>3</sup>	
3	100.9	11.9	1.0	1.38			1.2	.15	.87	.16
12	15.6	7.9	2.0	2.56	191.7	2.11	2.1	.26	.65	.12

<sup>1</sup> Farms are listed in the same order as in Table 25, page 426.

<sup>2</sup> Coal furnished by company that did threshing.

<sup>3</sup> Used wood.

tobacco and corn horse work with equipment was calculated at 15 cents per hour, the equipment allowance being 3 cents per hour. In preparing the statements for wheat the use of these items has been valued at 18 cents per hour, 6 cents being allowed for the use of equipment. Based on these assumptions the costs of producing wheat on farms 11 and 3 in 1923 were as follows: (See Tables 24 and 25.)

## FARM 11.

Man labor 11.2 hrs. @ 20c...	\$2.24
Horse work 24.4 hrs. @ 18c	4.39
Seed 1.7 bu.	2.12
Fertilizer 226 lbs.	1.74
Twine 2.3 lbs.	.24
 Total these items	\$10.73
Total yield per acre	15.7 bus.
Cost per bu. (excluding contract threshing):	
\$10.73 divided by 15.7	68c
equals	
Cost per bu. (including contract threshing):	
68c plus 20c equals	88c

## FARM 3.

Man labor 10.7 hrs. @ 20c...	\$2.14
Horse work 22.4 hrs. @ 18c	4.03
Seed 1.0 bu.	1.22
Fertilizer 77.9 lbs.	.91
Twine 1 lb.	.11
Coal for threshing	.07
 Total these items	\$8.48
Total yield per acre	7.1 bus.
Cost per bu. (excluding contract threshing):	
\$8.48 divided by 7.1	
equals	
Cost per bu. (including contract threshing):	
\$1.19 plus 10c equals	\$1.29

Thus, assuming that the value of wheat as a nurse crop plus the value of the straw were equal to the use of the land and using a rate of 20 cents per hour for man labor and 18 cents per hour for horse work with equipment the cost of producing wheat on farm 11 in 1923 was 88 cents per bushel. On farm 3 the cost was \$1.29 per bushel. The soils of these two farms were quite similar and yet the difference in unit costs appears to be largely due to differences in yield per acre.

There was little difference in the total amounts of man labor and horse work used on wheat on these two farms until the harvesting season. Both men used only a reasonable amount of labor in performing the particular operations selected. However, on farm 3 practically all the area sown in wheat was broken or fallowed especially for wheat. So much time was used in breaking the acreage decided upon that little opportunity was given for working the seed bed into a compact condition. On farm 11 the entire acreage of wheat was sown after tobacco and corn, consequently no breaking was necessary. The soil was well pulverized and a firm, compact seed bed prepared. Fertilizer was used for the entire acreage on farm 11. Only a part of the acreage on farm 3 was fertilized. These differences help to explain why the yield per acre was more than twice as large on farm 11 as on farm 3. The difference in the amounts of labor used in cutting, shocking, threshing and marketing may be accounted for by the difference in yields.

**MIXED HAY**

*Man Labor and Horse Work Used in Producing Mixed Hay.* The hours of man labor and horse work used in producing mixed hay, for the years 1923, 1922 and 1921, are shown, by operations, in Tables 27, 28 and 29. These tables include the labor used for the operations listed and in most cases the hay was left ricked or stacked in the field. On a few of the farms the hay was hauled to the barn, but in such cases a fork was used for unloading so that the labor requirements were about the same as where the hay was ricked in the field.

The hay for which the labor was reported usually was clover alone or a mixture of clover and redtop or clover and timothy. On most of the farms clover was seeded in late February and March. Redtop and timothy usually were seeded with a small grain crop late in September or October. On some of the farms part of the land was prepared especially for the hay crop. In 1922 the entire acreage seeded on farm 8 was plowed, disked, harrowed and dragged. This accounts for the large amount of labor reported for that farm. On some of the farms the young hay and weeds made enough growth during the first season to make clipping advisable. This was done on about one-third of the farms, and on these only a part of the hay area was clipped. The hay crop was cut the second summer after seeding. For 1923 the man labor and horse work used in cutting were kept separate from that used in raking, hauling and stacking. These operations have been combined for 1921 and 1922. The higher labor requirements for 1922 are explained partly by the fact that a large number of farmers found it necessary to prepare part of the land especially for the hay crop harvested in that year.

*Materials and Equipment Used in Producing Mixed Hay.* The amounts and values of materials used in producing hay were fairly uniform from farm to farm for a given year. The usual rate of seeding red clover was 1 bushel to 5 to 8 acres. A common rate of seeding redtop was 1 bushel to 2 to 3 acres and timothy was generally seeded at the rate of 1 bushel to 3 to 5 acres. A common rate of seeding for a hay mixture was 1 bushel of clover and 1 bushel of redtop to about 7 acres. Interest, taxes, depreciation and insurance on equipment were the other important charges for producing hay. The equipment expense for hay usually ranged from 5 to 8 cents for each hour of horse work used.

*Calculating the Cost of Producing Mixed Hay.* In a manner similar to that suggested for the other crops the labor and material requirements are used in calculating the cost of producing hay. In addition to the crop harvested the hay field usually provided considerable pasture. A hay crop usually is necessary in a rotation if erosion is to be

TABLE 27.—Hours Man Labor and Horse Work Used in Producing Mixed Hay, by Operations, 1923.  
(Acre Basis)

Farm No. <sup>1</sup>	Acres Per Farm	Yield Per Acre (Tons)	Seeding <sup>2</sup>		Clipping <sup>2</sup>		Cutting		Raking, Hauling and Stacking		Total Hours Per Acre
			Man	Horse	Man	Horse	Man	Horse	Man	Horse	
5	33.0	1.5	.6		1.1	2.2	1.4	2.7	9.4	5.4	11.4
14	44.5	1.4	.5		.3	.6	1.0	2.0	7.6	7.5	10.2
3	48.5	.8	.5				1.0	1.9	4.8	4.2	6.6
1	24.0	1.1	.8				1.8	3.5	7.6	8.0	10.2
13	19.1	.8	.8				1.6	2.8	4.5	2.8	6.9
11	51.5	1.1	.7				1.2	2.3	8.6	7.1	10.5
4	21.0	.5	.6		.3	1.2	2.5	1.4	2.3	4.8	2.1
6	21.0	1.3	.7				1.3	2.7	10.4	10.9	12.4
8	16.7	.9	.6				1.1	2.2	5.0	4.7	6.7
2	19.8	.9	.9				1.6	3.1	8.2	8.0	10.7
9	9.0	.7	1.7		1.0		1.6	3.1	5.3	4.0	8.6
10	17.4	.5	.5		.1		.9	1.7	6.9	6.9	8.3
Av.	25.0	1.0	.7				.6	1.2	2.4	7.1	9.3

<sup>1</sup>Farms are listed in order of man hours expended per ton of hay during the three-year period, 1921-23, inclusive, beginning with the lowest.

<sup>2</sup>Expressed on the basis of total acres harvested.

TABLE 28.—Hours Man Labor and Horse Work Used in Producing Mixed Hay, by Operations, 1922.  
(Acre Basis)

Farm No. <sup>1</sup>	Acres Per Farm	Yield Per Acre (Tons)	Seeding <sup>2</sup>		Clipping <sup>2</sup>		Harvesting		Total Hours Per Acre	
			Man	Horse	Man	Horse	Man	Horse	Man	Horse
5	40.8	1.3					9.4	8.8	10.7	8.8
14	50.5	1.4		.5			15.8	12.8	16.3	12.8
7	10.0	.8	1.4	.9			4.9	5.4	6.3	6.3
3	11.9	.6	.7	.6			7.1	10.1	8.3	11.7
1	38.0	.9	1.8	2.3	.5	1.0				
13	29.4	.7	1.2	2.6	.9	1.8	7.6	7.3	9.4	9.6
11	55.6	.7	1.7	4.7			7.0	5.9	9.1	10.3
4	6.6	2.2	.9		1.0	2.0	8.5	10.3	10.2	15.0
6	41.3	.8	.7	.6			21.8	16.4	23.7	18.4
8 <sup>3</sup>	12.8	.9	10.4	19.8			10.6	10.5	11.3	11.1
2	17.6	.9	1.1				7.7	10.0	18.1	29.8
9	14.9	.7	2.7	4.7			15.9	13.9	17.0	13.9
12	20.4	.5			.7		9.2	8.0	11.9	12.7
10	6.9	1.1	2.2	4.4			7.1	7.3	8.3	8.7
Av.	26.5	.9	1.2	1.7	.1	.2	17.3	11.9	19.5	16.3
							10.3	9.7	11.6	11.6

<sup>1</sup> Farms are listed in the same order as in Table 27, page 430.<sup>2</sup> Expressed on the basis of total acres harvested.<sup>3</sup> Broke, disked and harrowed land for seeding. Not included in averages of man and horse hours.

TABLE 29.—Hours Man Labor and Horse Work Used in Producing Mixed Hay, by Operations, 1921.  
(Acre Basis)

Farm No. <sup>1</sup>	Acres Per Farm	Yield Per Acre (Tons)	Seeding <sup>2</sup>		Clipping <sup>2</sup>		Harvesting		Total Hours Per Acre	
			Man	Horse	Man	Horse	Man	Horse	Man	Horse
5	14.8	1.0	.8	2.0			7.0	6.9	7.8	8.9
7	3.5	.9	2.9				9.2	14.9	12.1	14.9
3	32.5	.6	.4				9.2	12.7	9.6	12.7
1	54.6	.8	1.6	3.8			9.3	10.2	10.9	14.0
13	29.3	.5	.8	.3	1.4	2.7	4.6	4.2	6.8	7.2
11	56.2	.6	.4	1.5	1.2	2.4	6.4	11.0	8.0	14.9
4	9.3	1.0	.9		.6	1.3	8.9	7.7	10.4	9.0
6	27.7	.7	.4				7.8	11.2	8.2	11.2
12	14.7	.4	1.4				4.9	4.9	6.3	4.9
10	4.0	.8	2.0				10.0	8.0	12.0	8.0
Average	24.7	.7	.8	1.4	.5	.9	7.5	9.5	8.8	11.8

<sup>1</sup> Farms are listed in the same order as in Table 27, page 430.  
<sup>2</sup> Expressed on the basis of total acres harvested.

prevented and the fertility of the soil maintained. For these reasons no land charge is included in working out cost statements for hay. The same rates are used for man labor and horse work with equipment that were used in preparing the wheat statements. On this basis the man labor, horse work and material costs for producing mixed hay on farms 5 and 10 in 1923, were as follows: (See Table 27.)

## FARM 5.

Man labor 11.4 hrs. @ 20c...	\$2.28
Horse work 8.1 hrs. @ 18c...	1.46
Seed—Clover 1/7 bu. @	
\$14.00	2.00
Redtop 1/7 bu. @ \$3.50	.50
Total these items .....	\$6.24
Total yield per acre.....	1.5 tons
Cost per ton: \$6.24 divided by 1.5 equals .....	\$4.16

## FARM 10.

Man labor 8.3 hrs. @ 20c...	\$1.66
Horse work 8.6 hrs. @ 18c...	1.55
Seed—Clover 1/7 bu. @	
\$14.00	2.00
Redtop 1/7 bu. @ \$3.50	.50
Total these items .....	\$5.71
Total yield per acre.....	.5 tons
Cost per ton: \$5.71 divided by .5 equals .....	\$11.42

Thus, assuming that the pasturage provided by the hay field and the place that the crop filled in the rotation offset the value of the use of the land, and with man labor at 20 cents per hour, horse work with equipment at 18 cents per hour and seed used and valued as above the cost of producing mixed hay on farm 5 in 1923 was \$4.16 per ton. On farm 10 the cost was \$11.42 per ton. This difference was due largely to the difference in yields and it appears that in these particular cases the reasons were largely without the farmers' control. The soil was better adapted to growing hay on farm 5 than the soil on farm 10. This suggests, however, that if the operator of farm 10 is to compete with the operator of farm 5 in producing hay he must find some way to increase the yield above one-half ton per acre or else keep the hay acreage low enough that it will not seriously interfere with the more profitable crops on his farm. Possibly some pasture grasses in addition to the hay crop would better serve the needs of farm 10 than a large acreage devoted to the production of mixed hay.

It is realized that the cost statements that have been presented are not complete enough to provide a basis for determining the relative profitability of the different crops. However, the assumptions and methods of calculation are the same for the two farms for each crop and it is believed that the costs shown are an approximate index of the efficiency of the growers of the particular crop for the year taken. In each case the costs have been based upon the man labor, horse work and materials actually used and yields obtained by the most efficient and least efficient growers as indicated by the amounts of man labor and horse work used in producing a unit of the particular product. In other words, the cost index used in the appendix serves as a check on the labor requirement index used in the first part of the bulletin.

Costs may be calculated for the other farms by assigning values to the man labor, horse work and materials used and applying them to the yields shown. In a similar manner costs may be approximated for particular operations or groups of operations. It is expected that if costs were calculated for all the farms for each crop that most of these unit costs would lie within the range suggested by the unit costs shown. It is believed that the more important reasons for the variations have been mentioned.